

LA-UR-21-27975

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Title: Microbial Carbon Cycling in Terrestrial Ecosystems Phase V: Mechanisms that create and maintain microbially-driven variation in carbon fate

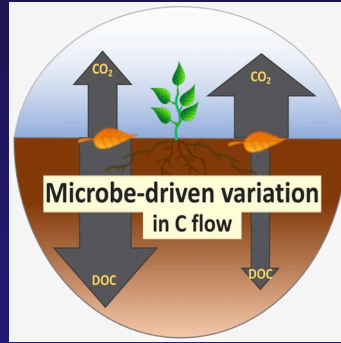
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Intended for: SFA renewal defence

Issued: 2021-08-10

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Microbial Carbon cycling in Terrestrial Ecosystems:

Phase V: Mechanisms that create and maintain microbially-driven variation in carbon fate

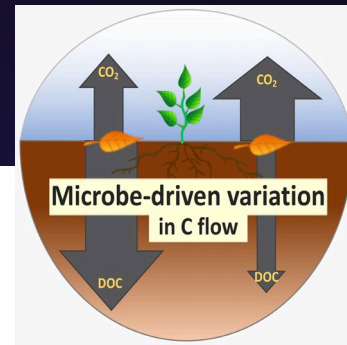
Objective 3

Sanna Sevanto

August 17, 2021

Objective 3: Manipulating C flow in natural systems

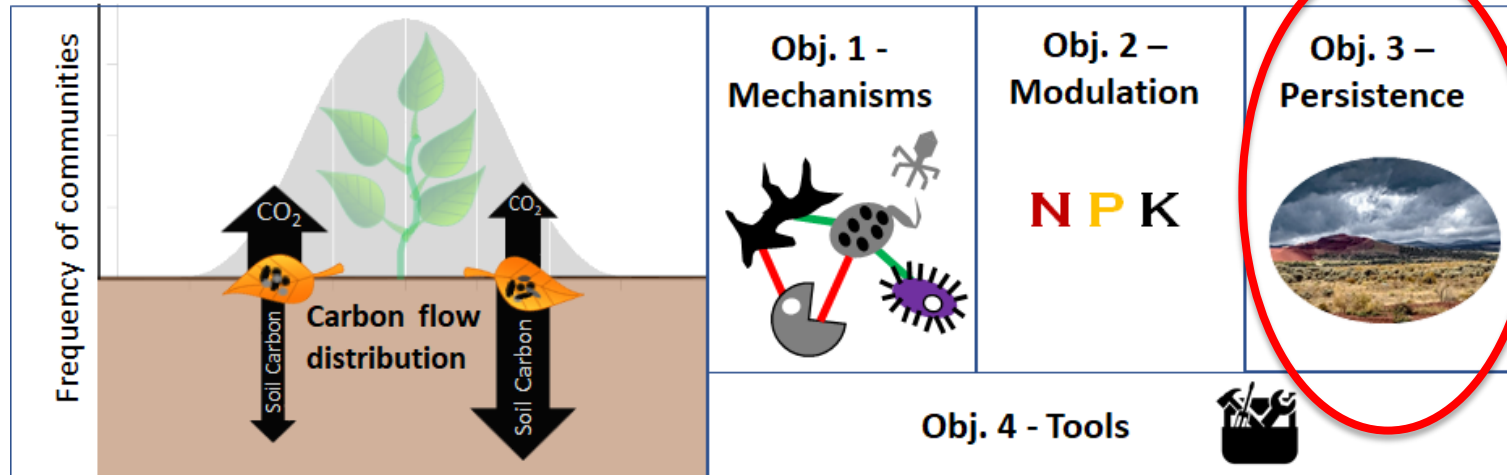
(Sanna Sevanto, LANL)



- Understanding temporal dynamics of microbial driven surface litter decomposition, and how microbial phenotype can be controlled

- **Tasks**

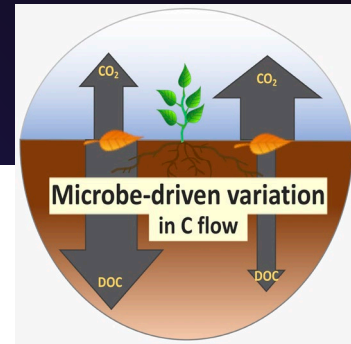
- 1) 3.1.1 Multi-year field experiment (LANL)
- 2) 3.1.2 Multi-year laboratory experiment (LANL)



Motivation: What did we learn in Phase IV

12-month field experiment with litter “traps”

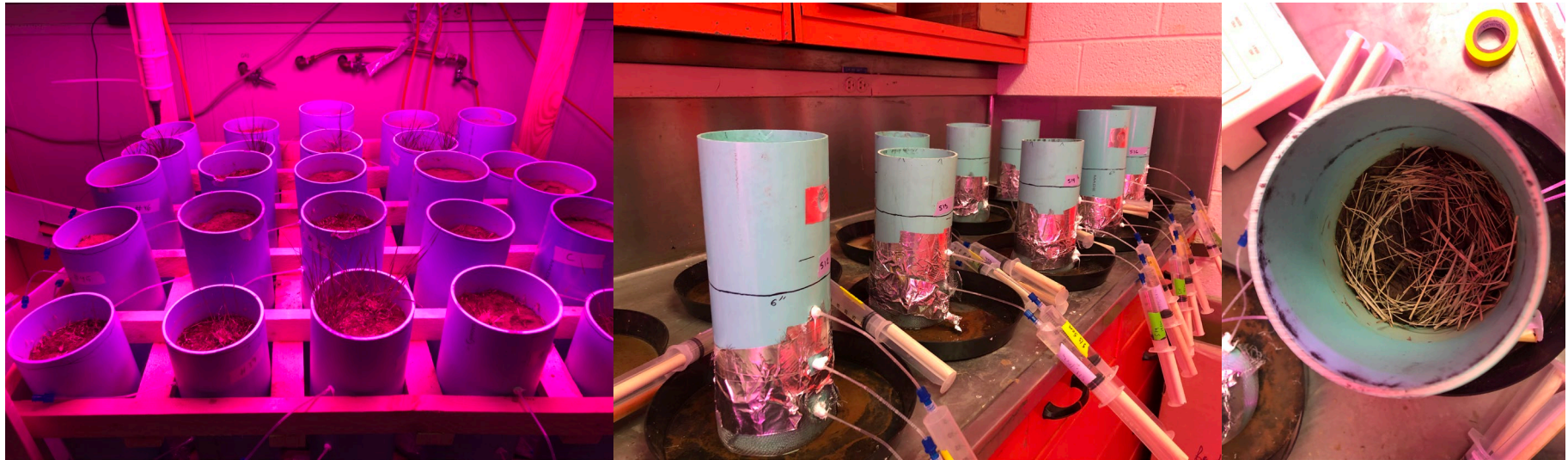
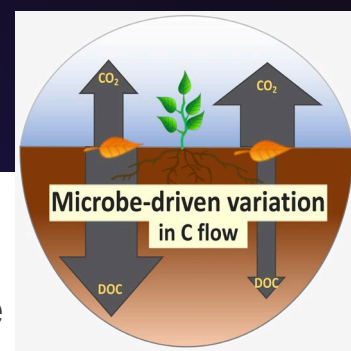
-How does microbial driven surface litter decomposition behave in variable climatic conditions in the field?



Motivation: What did we learn in Phase IV

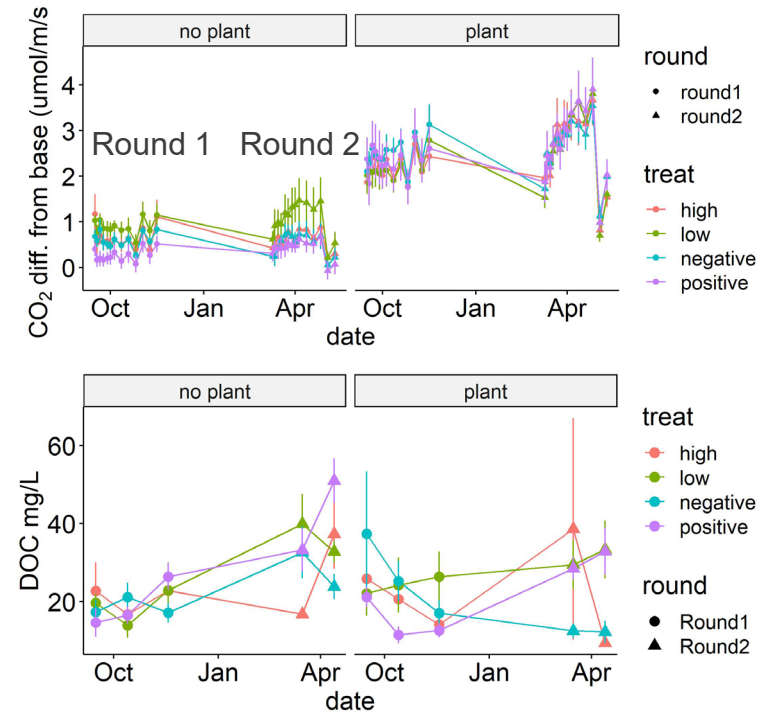
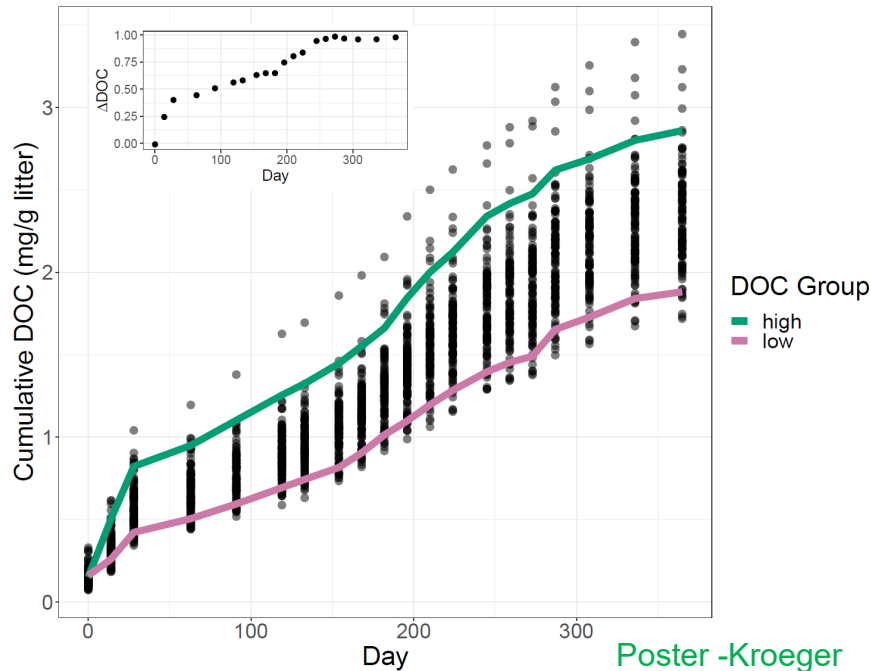
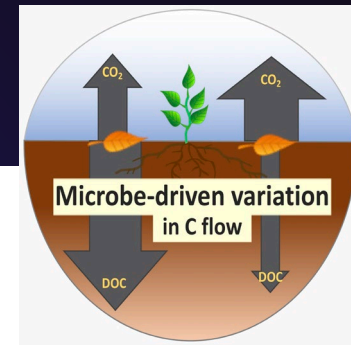
Two generation test with natural soil cores

-Does microbial driven surface litter decomposition make a difference in carbon cycling on natural soil and with plants?



Motivation: What did we learn in Phase IV

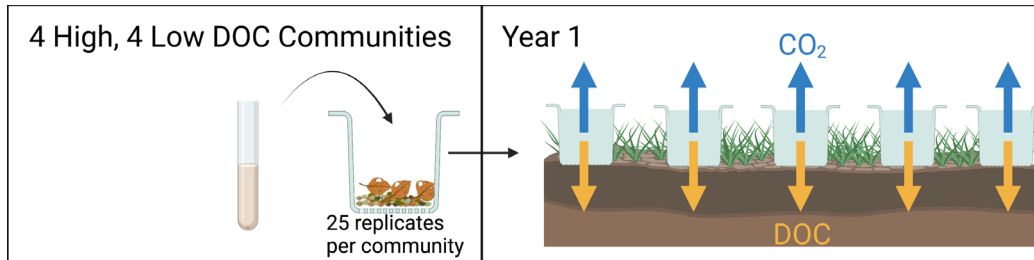
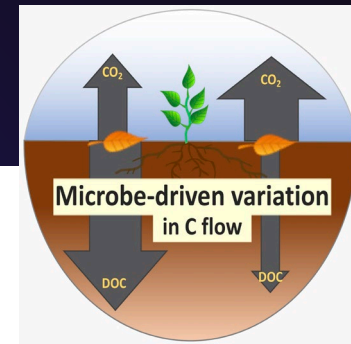
- Surface litter decomposition **can change C cycling in variable field conditions** as well as on natural soil
- The initial microbiome phenotype is not always maintained



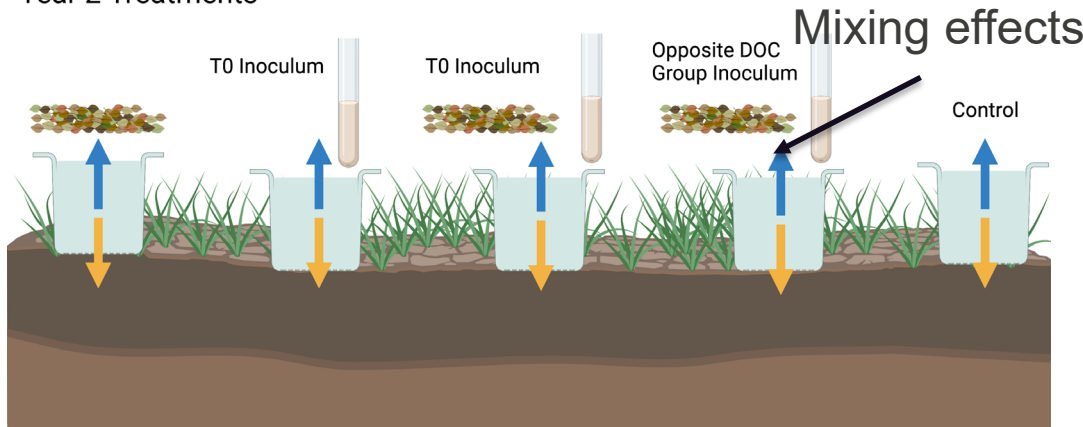
Task 3.1.1

Conduct a **multi-year field experiment** to

- Test if, and how re-inoculations and litter addition will strengthen the microbiome phenotype



Year 2 Treatments



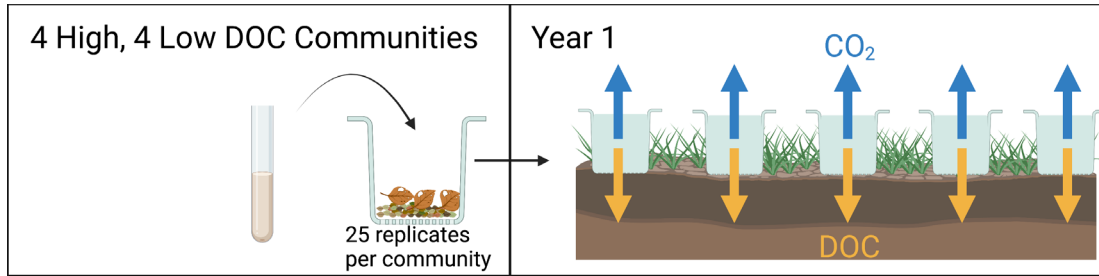
Hypotheses:

-The C flow pattern created by the initial microbial inoculum will be maintained if new litter and additional microbial inoculum is added to old litter.

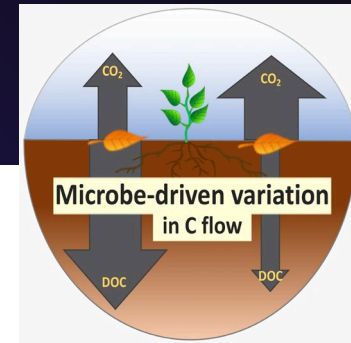
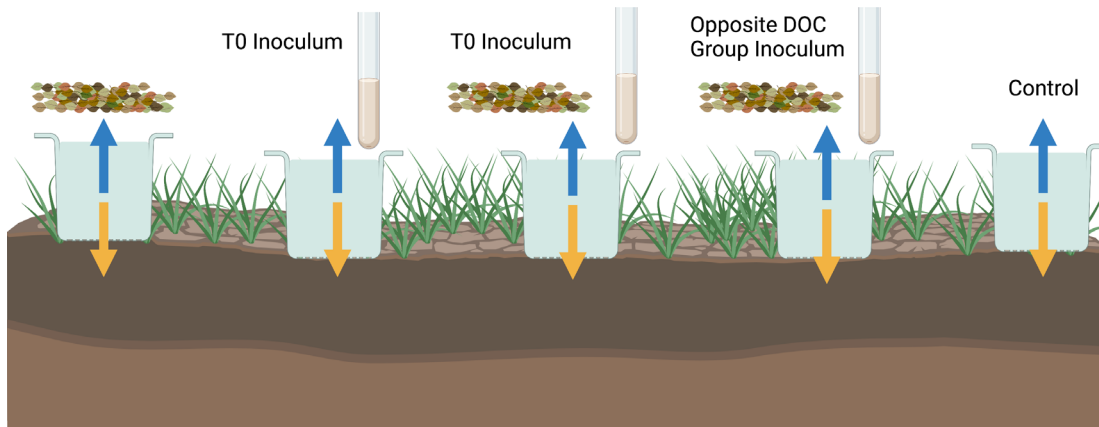
-A new successional pattern will merge when only 'new' litter is added, and the C flow pattern from year one will be maintained.

-High and low DOC phenotypes will react differently to addition of litter only or litter with inoculum.

Measurements



Year 2 Treatments

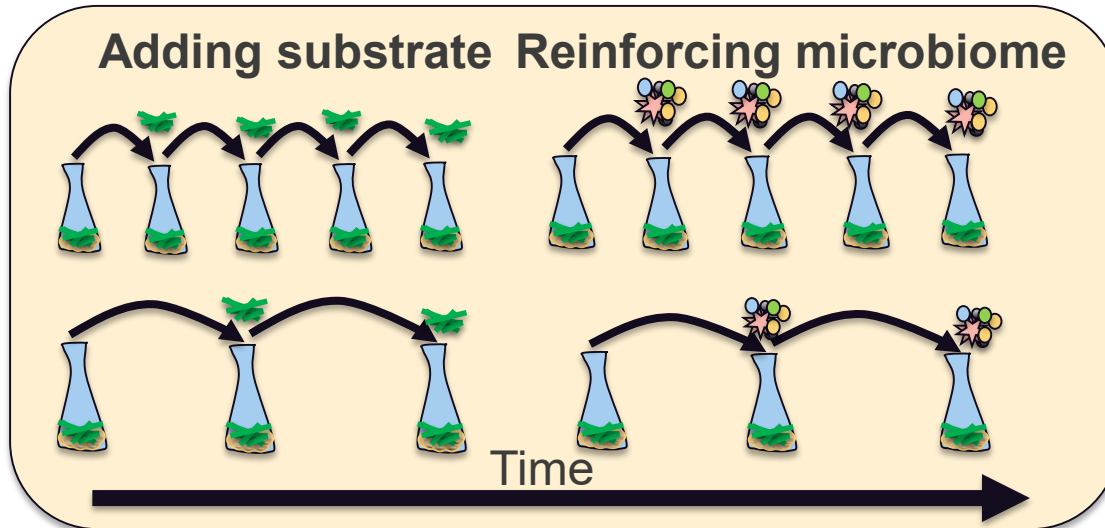
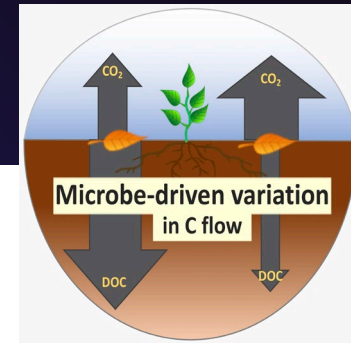


- CO₂ flux
- DOC accumulation
- Community composition (initial and before each re-inoculation)
- Litter mass loss

Task 3.1.2

Conduct a multi-year **laboratory experiment**

- Test if, and how, re-inoculations and litter addition will strengthen the microbiome phenotype in **controlled conditions**
- **Goal:** To understand mechanisms that control microbiome phenotype and shed light on how, and at what points during decomposition process the phenotype can be controlled



Hypotheses:

- A *higher frequency* of re-inoculation alone will *strengthen* the DOC phenotype.
- Litter addition alone* will *maintain* the DOC phenotype when added during late-stage decomposition
- A *combination of increased frequency of re-inoculation and early addition of litter* will *strengthen* the DOC phenotype.

Phase V outcome

The ability to predictably alter C flow from surface litter decomposer communities over multi-year time scales in semi-controlled systems

